

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
25 September 2003 (25.09.2003)

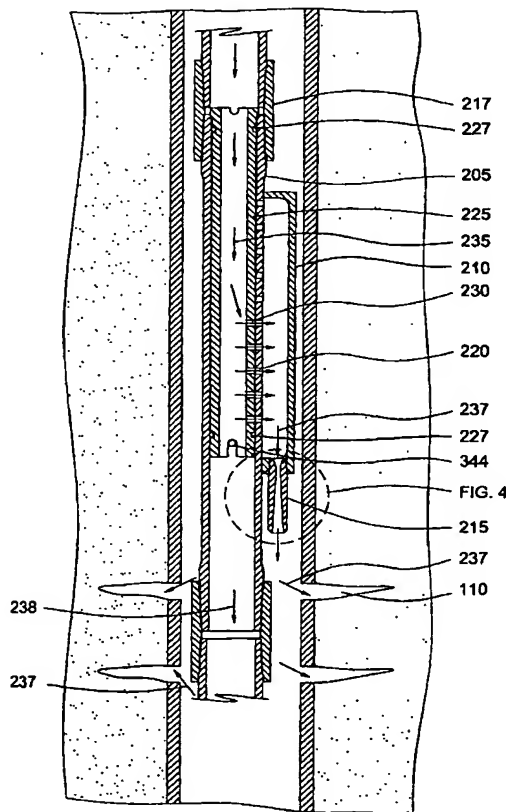
PCT

(10) International Publication Number
WO 2003/078791 A3

- (51) International Patent Classification⁷: **E21B 43/24**, 41/00
- (21) International Application Number: **PCT/US2003/007771**
- (22) International Filing Date: 13 March 2003 (13.03.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
10/097,448 13 March 2002 (13.03.2002) US
- (63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:
US 10/097,448 (CIP)
Filed on 13 March 2002 (13.03.2002)
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR INJECTING STEAM INTO A GEOLOGICAL FORMATION



(57) Abstract: The present invention generally provides a method and apparatus for injecting a compressible fluid at a controlled flow rate into a geological formation at multiple zones of interest. In one aspect, the invention provides a tubing string with a pocket and a nozzle at each isolated zone. The nozzle permits a predetermined, controlled flow rate to be maintained at higher annulus to tubing pressure ratios. The nozzle includes a diffuser portion to recover lost steam pressure associated with critical flow as the steam exits the nozzle and enters a formation via perforations in wellbore casing. In another aspect, the present invention assures that the fluid is supplied uniformly to a long horizontal wellbore by providing controlled injection at multiple locations that are distributed throughout the length of the wellbore. In another aspect, the invention ensures that saturated steam is injected into a formation in a predetermined proportion of water and vapor by providing a plurality of apertures between a tubing wall and a pocket. The apertures provide distribution of steam that maintains a relative mixture of water and vapor. In another aspect of the invention, a single source of steam is provided to multiple, separate wellbores using the nozzle of the invention to provide a controlled flow of steam to each wellbore.



(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv)) for US only

Published:

— with international search report

(88) Date of publication of the international search report:

15 January 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/07771

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B43/24 E21B41/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, TULSA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 648 455 A (LUKE MIKE A) 10 March 1987 (1987-03-10) abstract column 4, line 17-42 column 4, line 50-55 column 5, line 23-30 figures 1,3,4	1,3-10, 12-15, 23-25, 28,31-46
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Y	US 5 141 054 A (ALAMEDDINE BASSEM R ET AL) 25 August 1992 (1992-08-25) figure 3 --- -/-	2

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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G document member of the same patent family

Date of the actual completion of the international search

16 July 2003

Date of mailing of the international search report

29/07/2003

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/07771

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International Application No

PCT/US 03/07771

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